Validation of AIRS Version 5 Ozone Retrievals

AIRS Science Team Meeting – March 28, 2007

Bill Irion – Jet Propulsion Laboratory

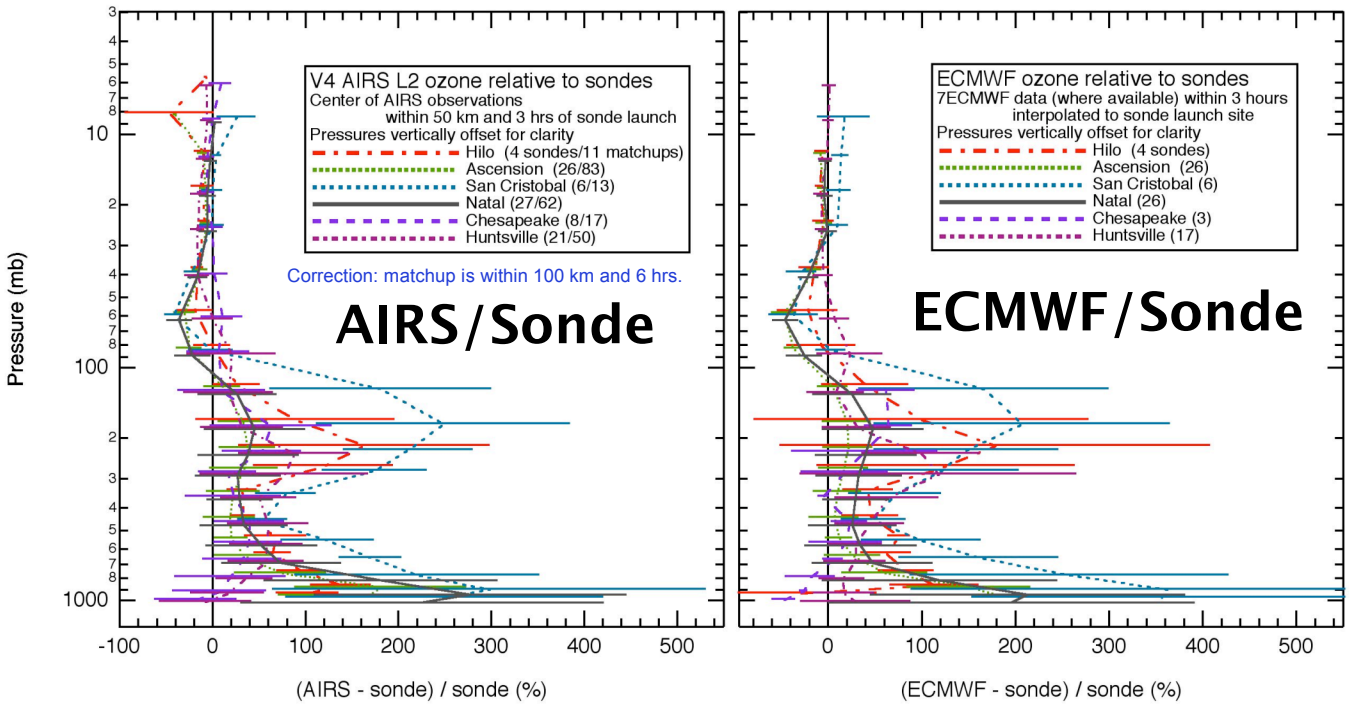
Michael Newchurch – U. Alabama at Huntsville

Sunmi Na – Pusan National University

With thanks to Sung-Yung Lee, Annmarie Eldering, Greg Osterman, John Blaisdell, Chris Barnet, Murty Divakarla, Jennifer Wei, Wallace McMillan, Steve Friedman and SHADOZ

The problem with Version 4 ozone

Relative differences of AIRS & ECMWF vs ozonesondes

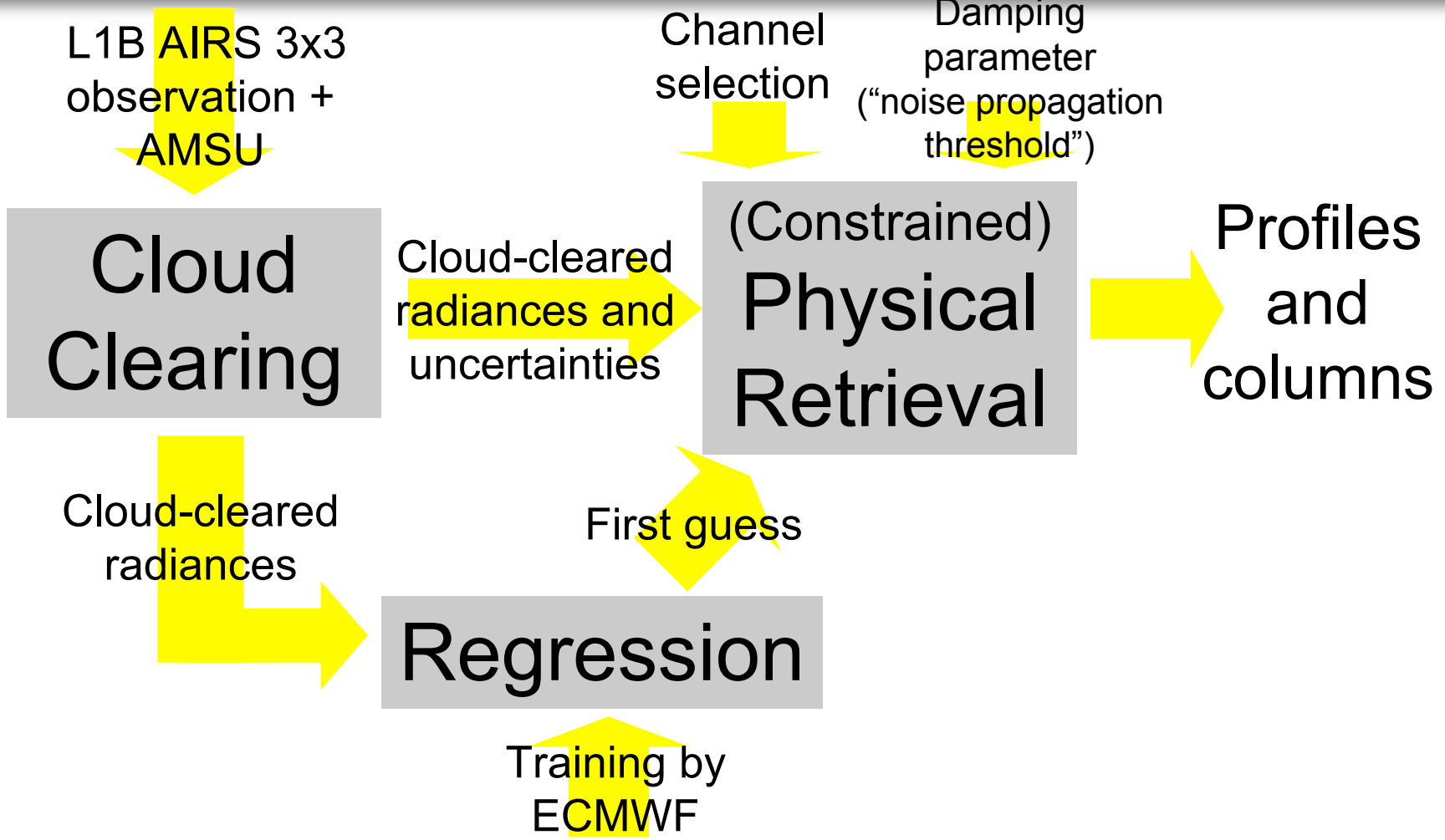


Standard deviations shown.

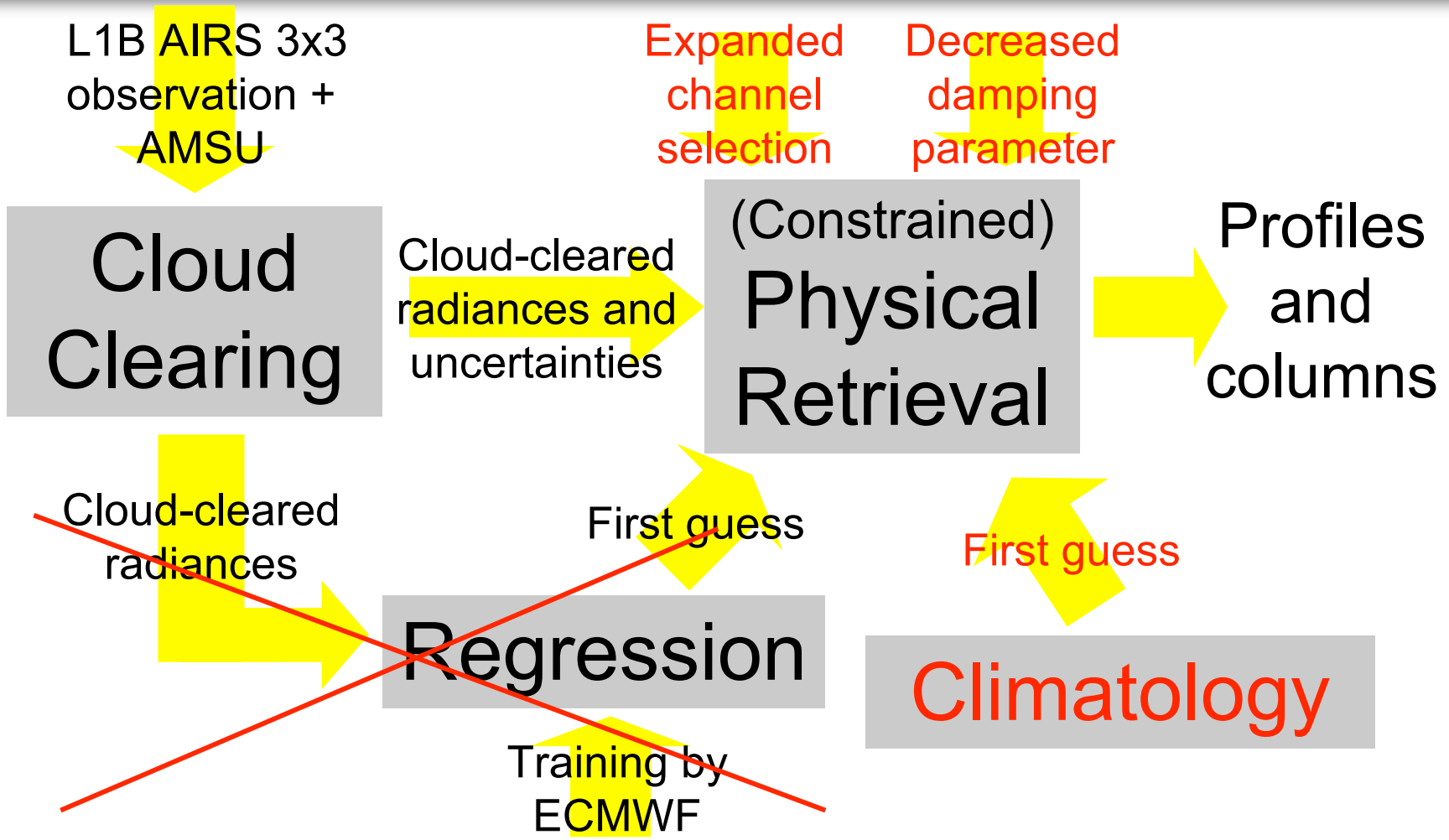
Pressures offset for clarity.

Like ECMWF, V4 AIRS is too high in troposphere and too low in lower stratosphere; column OK to first order.

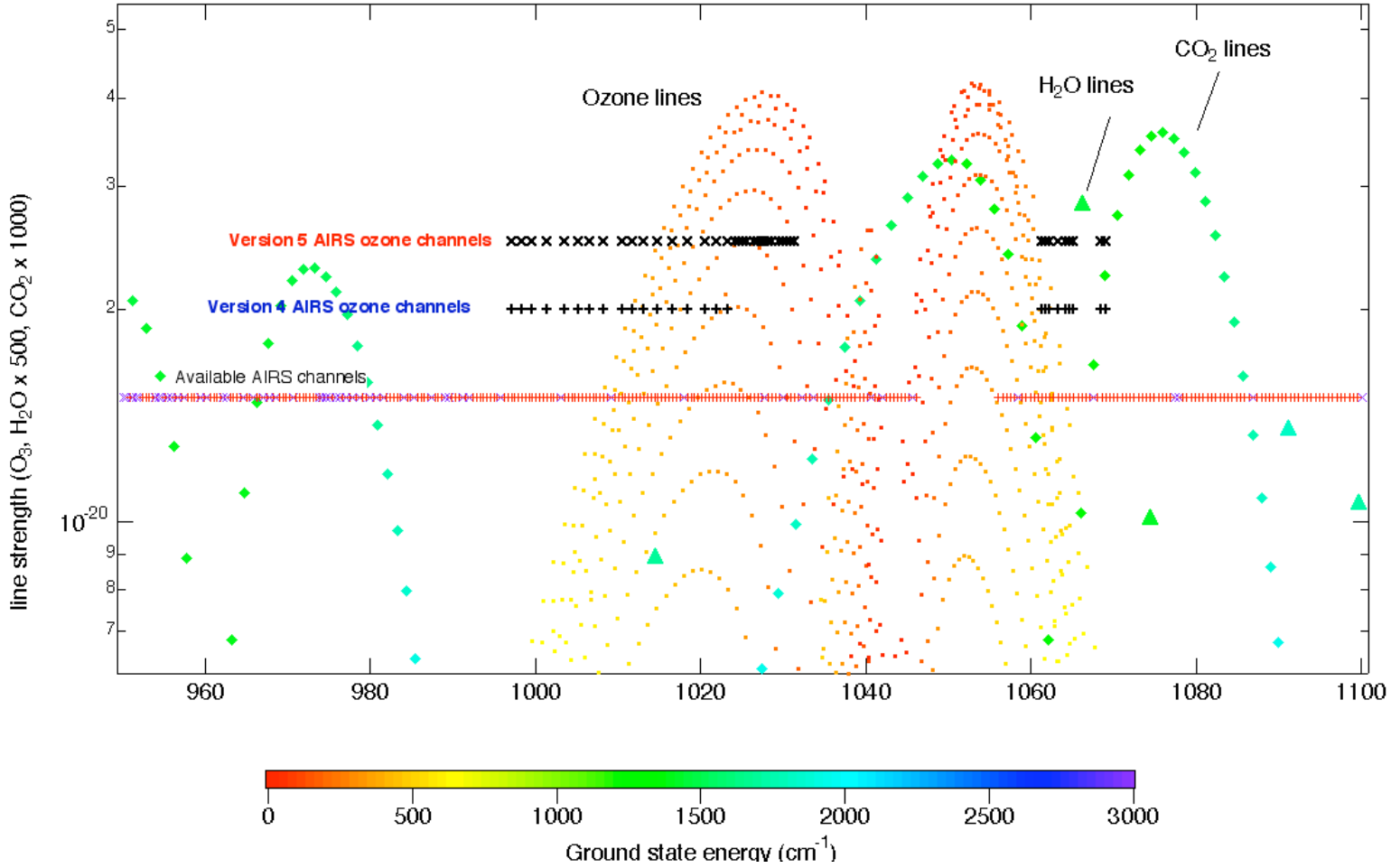
Simplified Version 4 algorithm for ozone



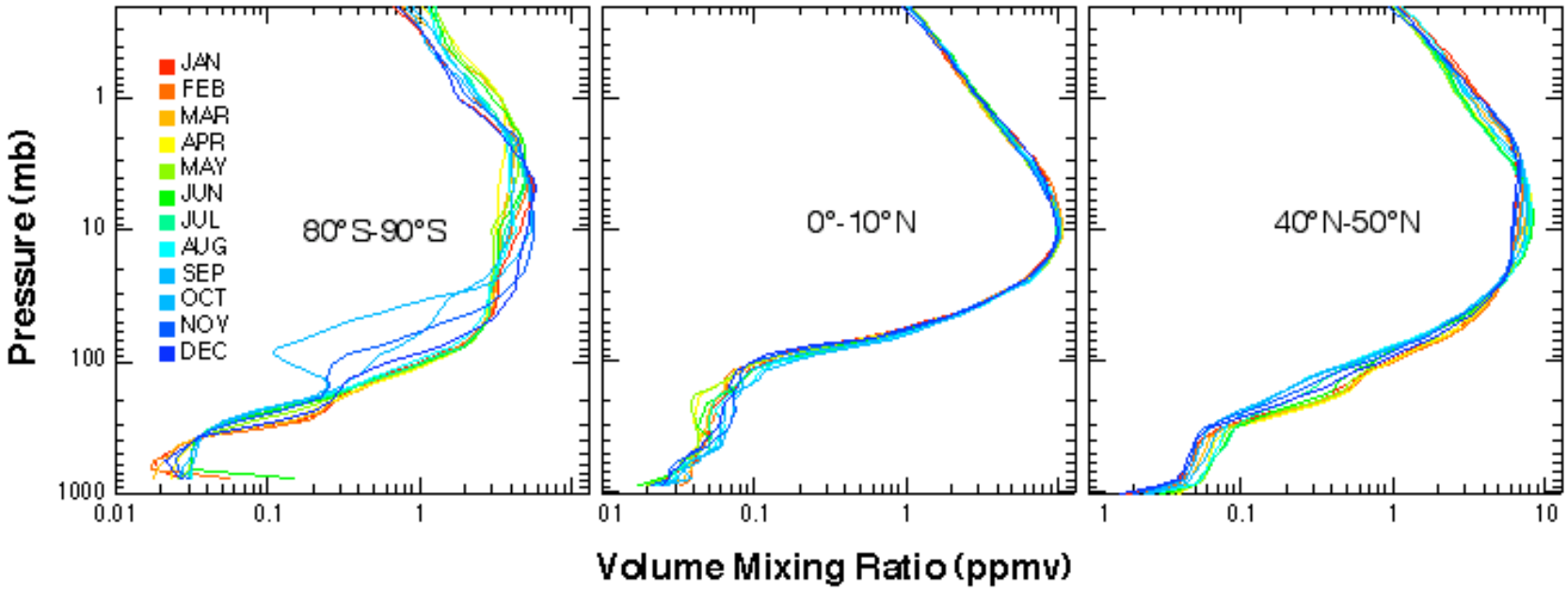
Changes in algorithm from V4 to V5 ozone



Channel selection changes



First O_3 guess from climatology

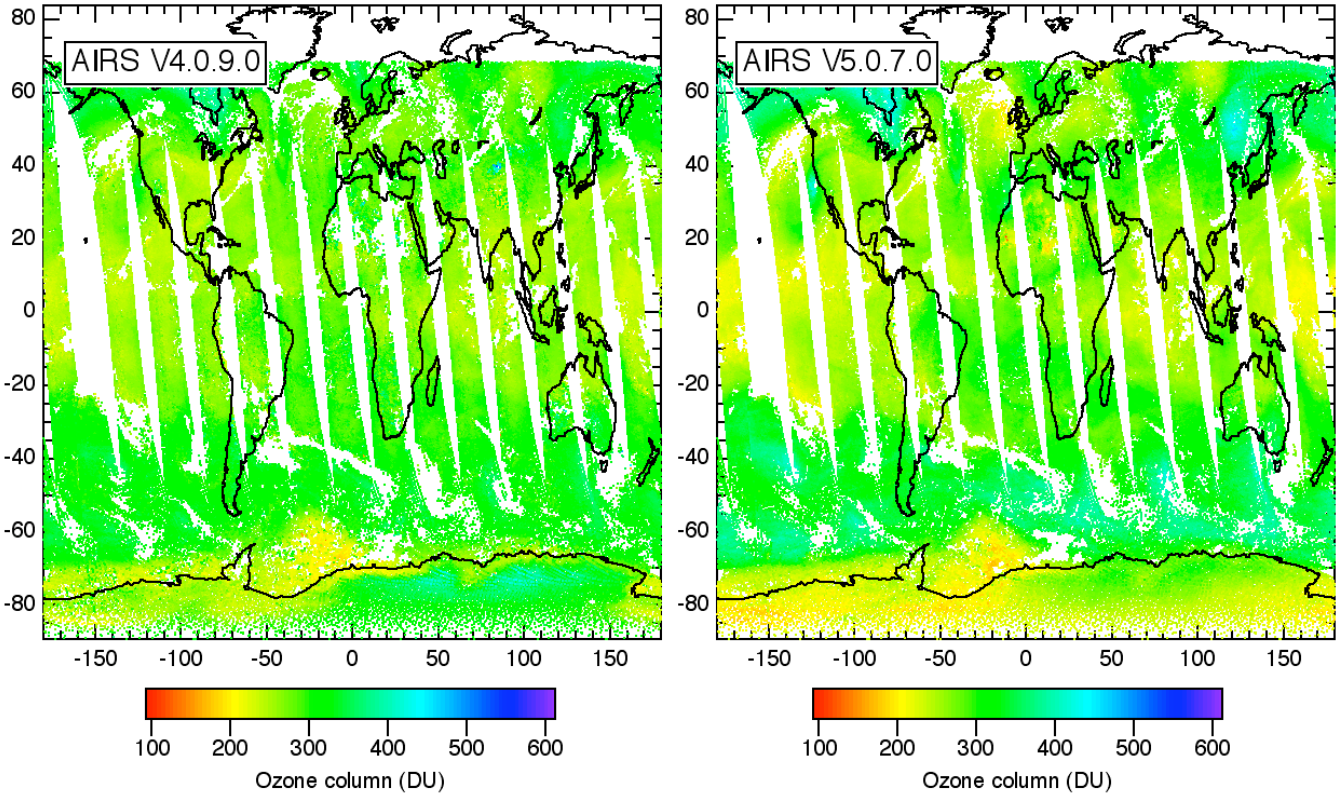


•Monthly zonal-mean climatology from combined ozonesonde, SAGE II and (at high latitudes) MLS measurements and used as *a priori* for TOMS Version 8 retrievals.

McPeters, R. D., J. A. Logan, and G. J. Labow (2003), Ozone Climatological Profiles for Version 8 TOMS and SBUV Retrievals, *Eos Trans. AGU, 87* (52), Fall Meet. Suppl., Abstract A21D-0998; McPeters, R.D., G. J. Labow, and J. A. Logan (2007), Ozone climatological profiles for satellite retrieval algorithms, *J. Geophys. Res., 112,* D05308, doi:10.1029/2005JD006823.

AIRS V4 and V5 total O_3 comparison

V5 ozone decreases along tropics and high southern latitudes.



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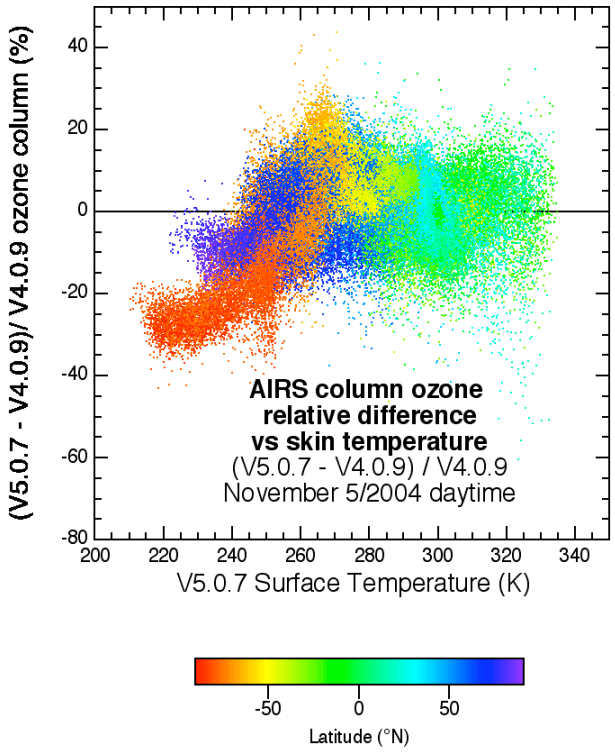
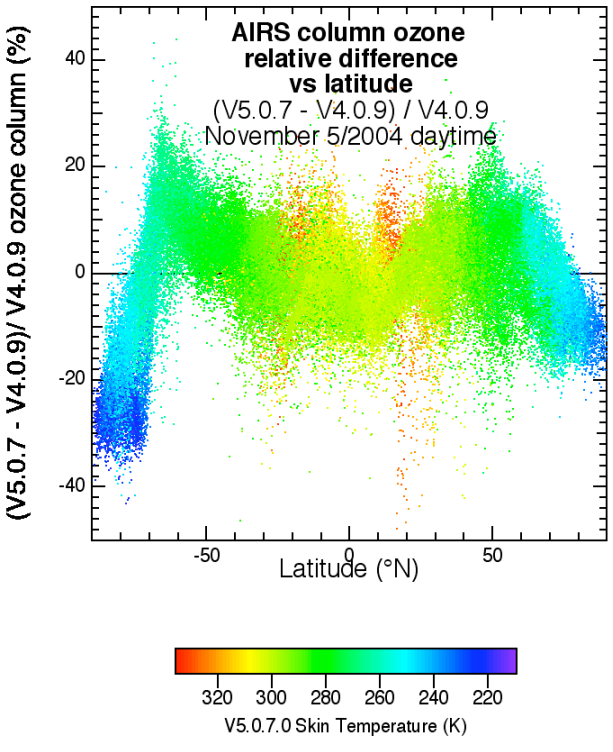
AIRS V4 and V5 comparison vs surface temperature

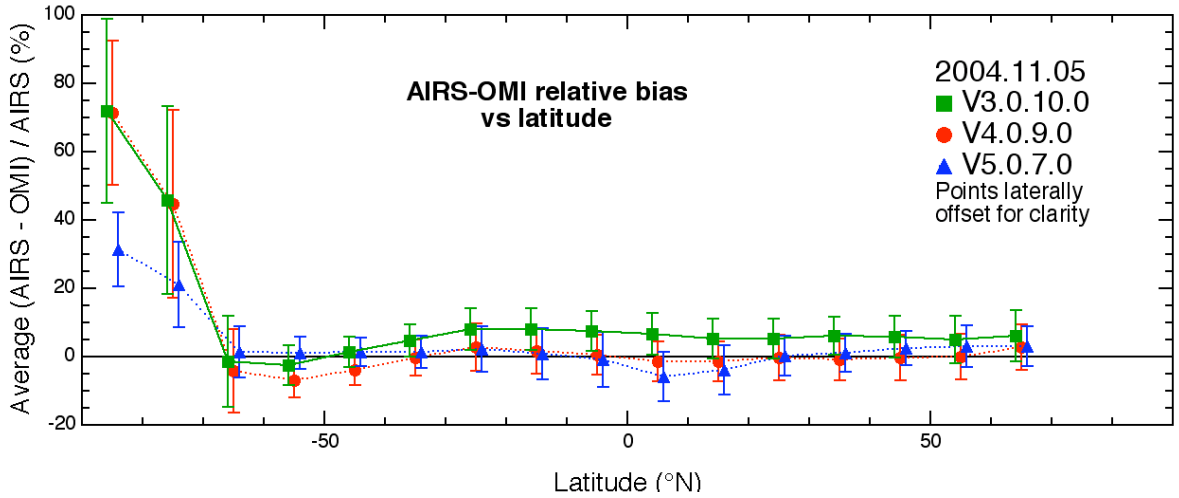
Large decreases in V5 in high latitude cold regions.

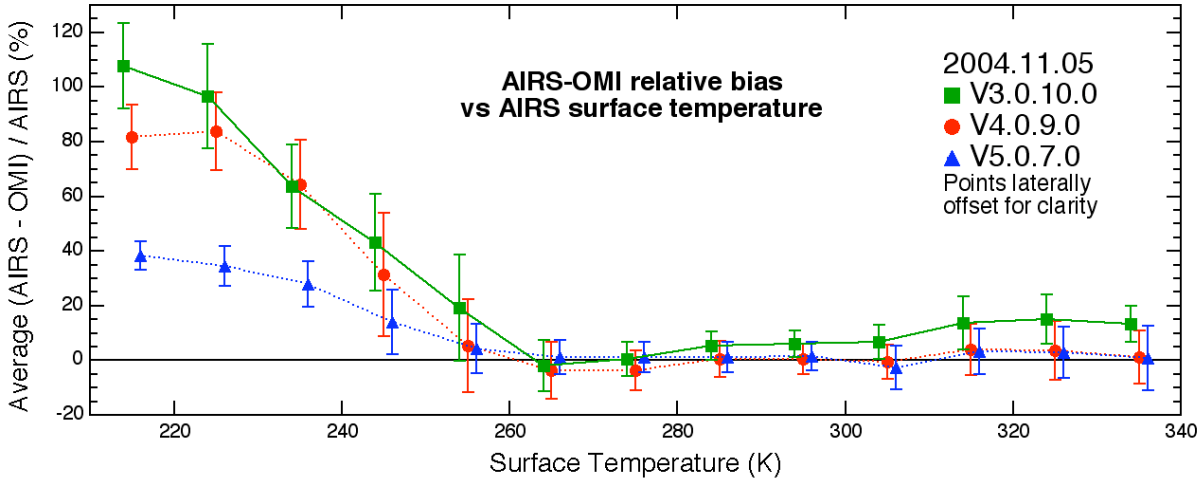




V3 V4 V5 total ozone comparisons with OMI

AIRS column ozone V3–>V4–>V5 show increasing agreement with OMI.

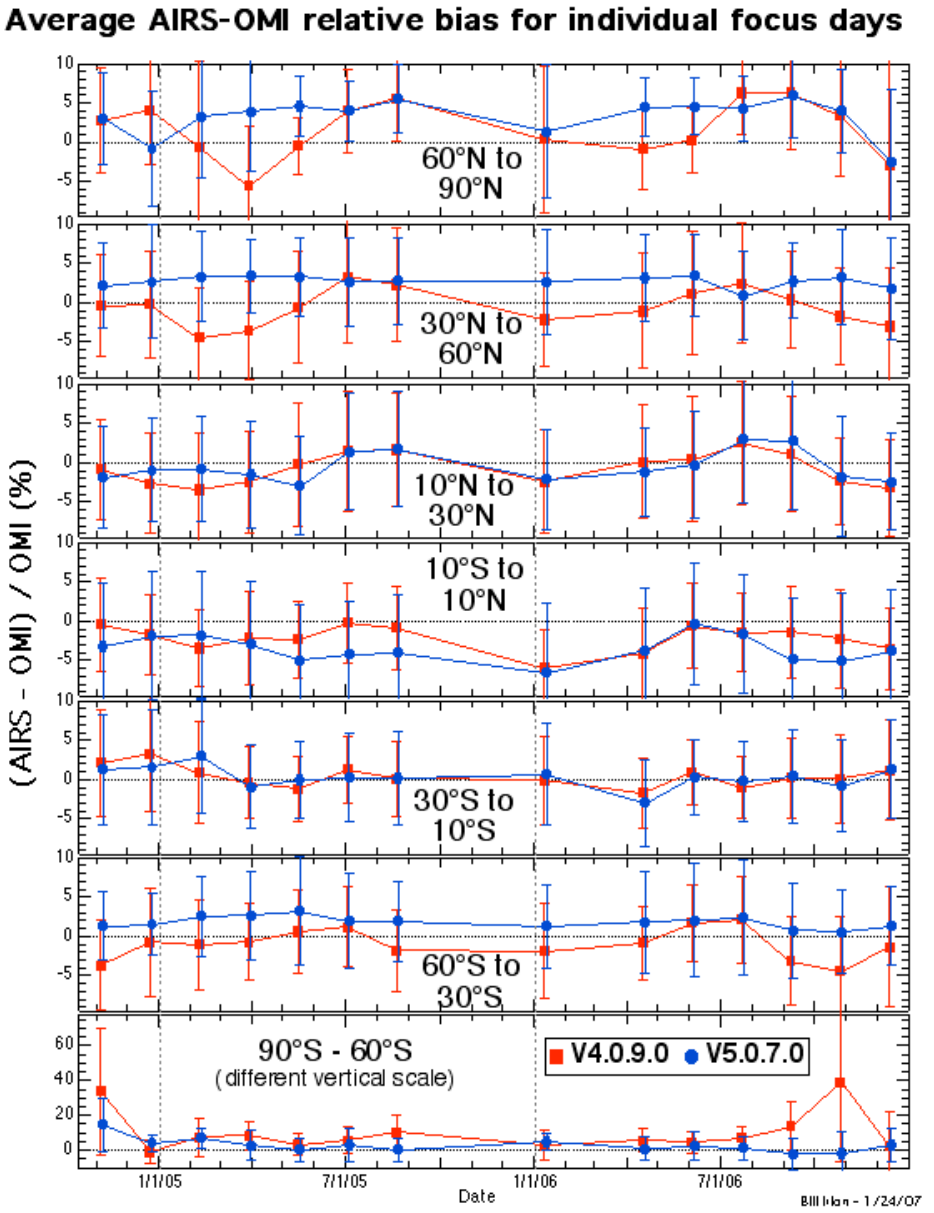




Zonal comparisons with OMI over Focus Days

Versions 4 and 5 AIRS ozone columns show comparable biases w.r.t OMI, except bias substantially lowered in southern high latitudes.

Need to compare to ground-based Dobson/Brewer measurements.



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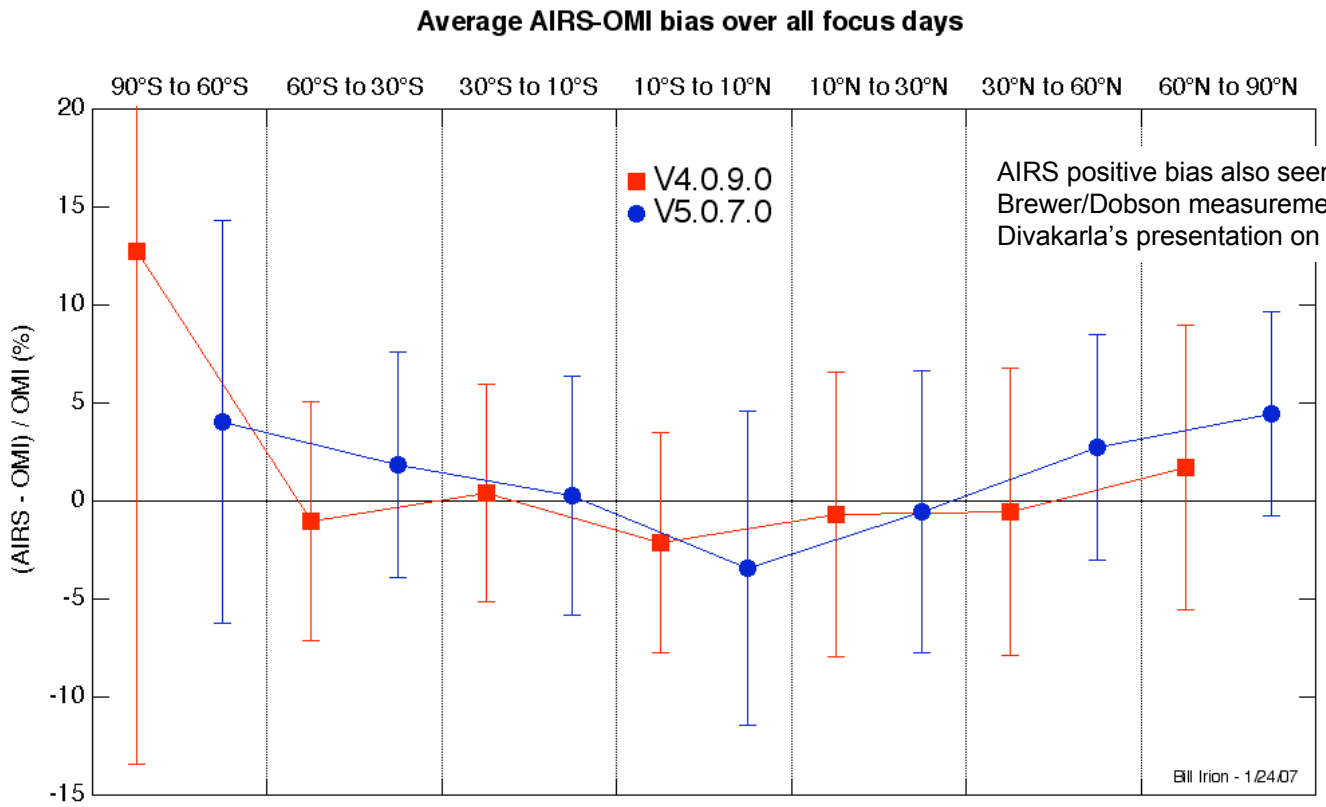
Average zonal bias over all Focus Days

AIRS Version 5 - OMI bias symmetric across equator.



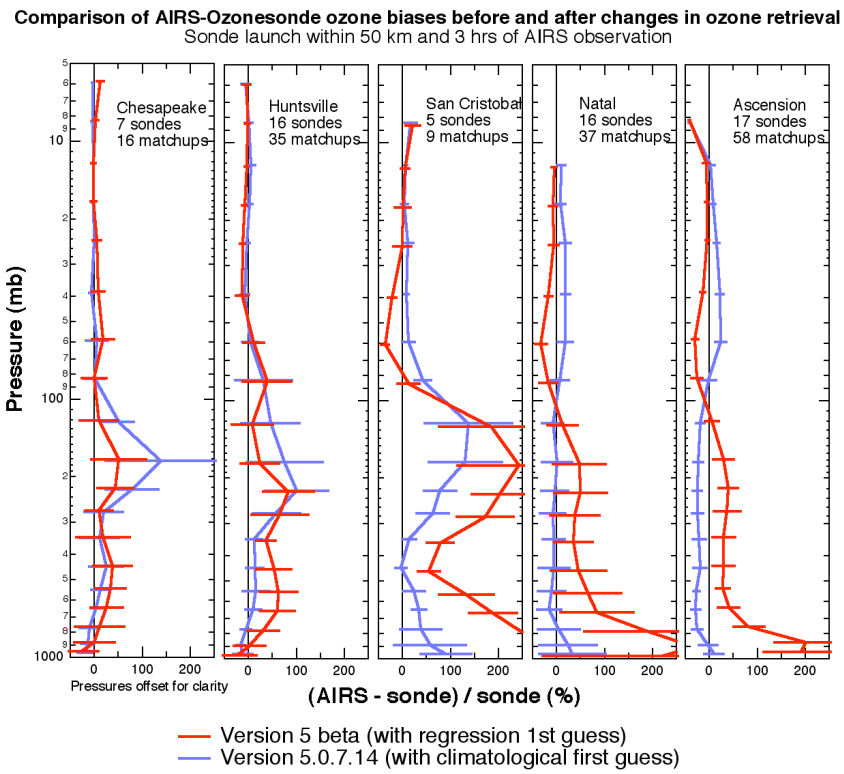
Sonde comparisons with and without regression

What does a climatology for the first guess do to the profile?

Retrievals using regression in red
Retrievals using climatology in blue
Same channels and damping for both

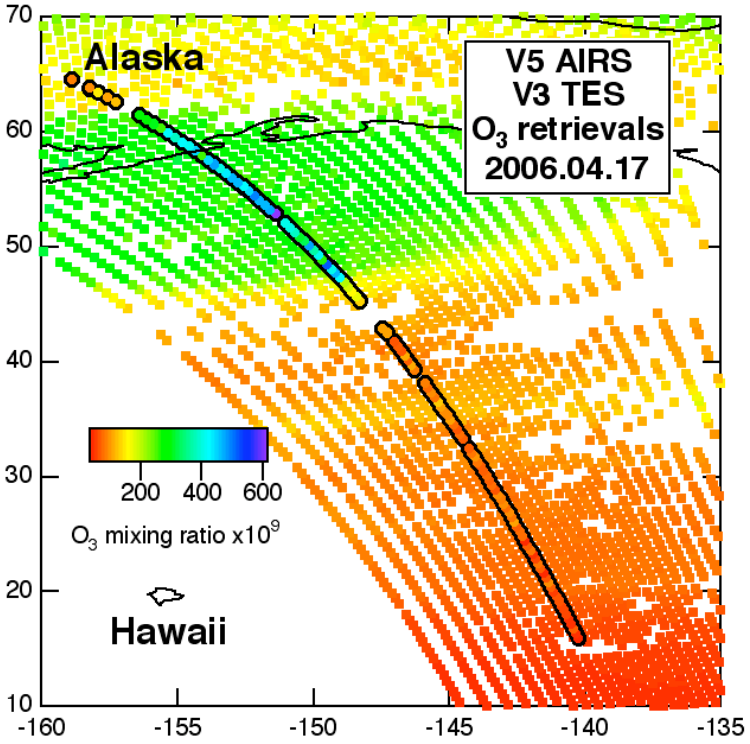
Generally improved agreement in mid-to-lower troposphere and lower stratosphere. Mixed results in upper troposphere.

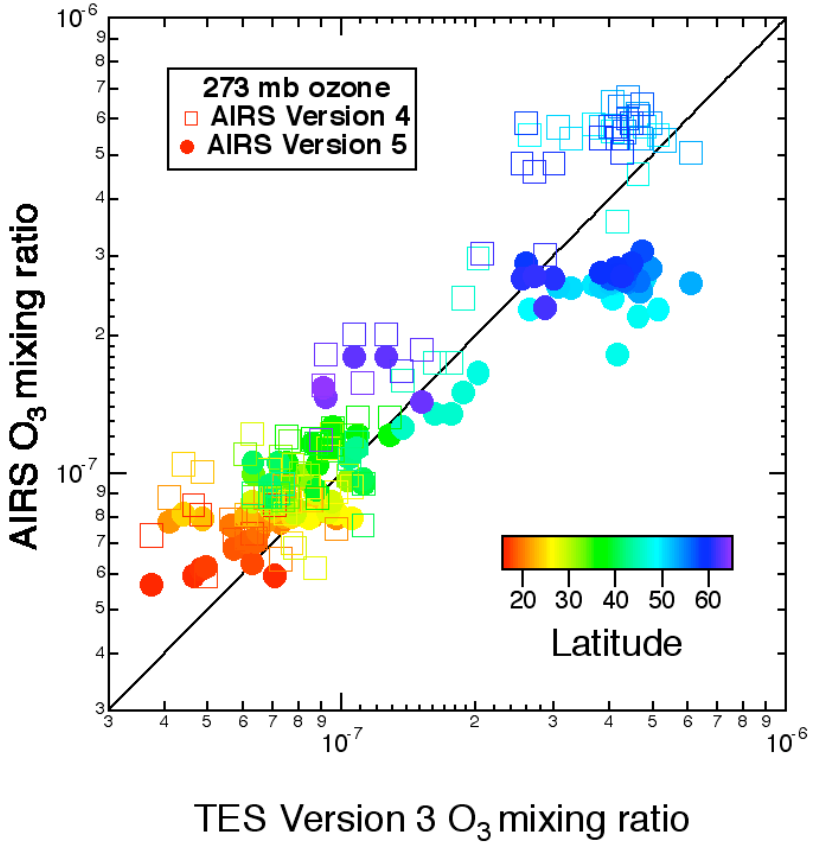
V5 AIRS-Sonde Average Relative Bias
Regression 1st guess Climatology 1st guess



Layer comparison with TES

At high ozone mixing ratios @ 273 mb 50°-60°N AIRS V4 is high w.r.t. TES while V5 is low.





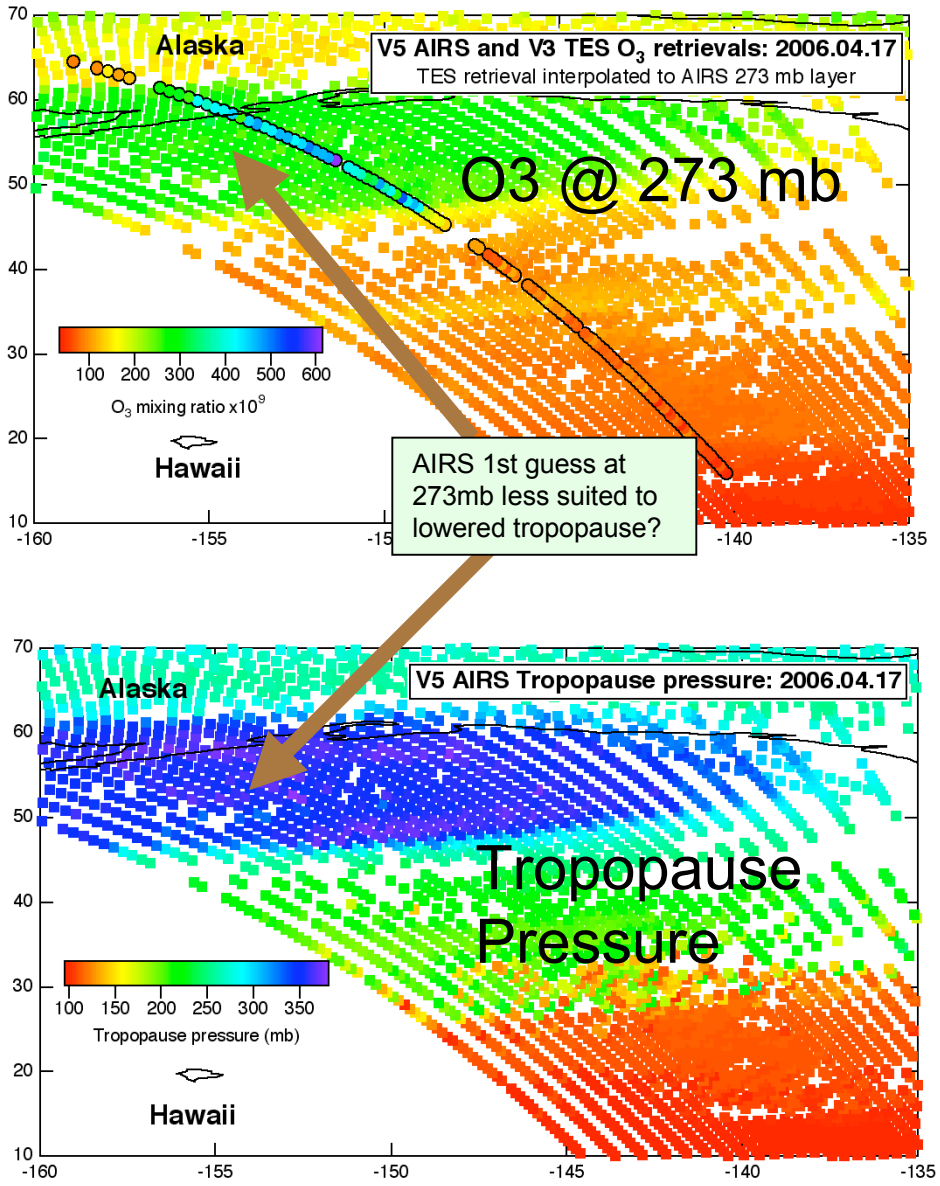
Pre-release TES Version 3 retrievals courtesy of Greg Osterman and Annmarie Eldering

AIRS-TES bias at 273 mb coincident with lower tropopause height

TES and AIRS show increased ozone, but AIRS mixing ratios lower than TES.

Would shifting first guess mixing ratio profile up or down with tropopause pressure change this?

Need to carefully look at information content and spectral fits.



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Ideas to try for Version 6

- Re-evaluate trapezoid levels?
- Shift *a priori* mapping up or down with retrieved tropopause pressure?
- Based on tests deciding new damping factor…
  - Dynamically modify damping factor with skin temperature or tropopause height?

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Thanks for your time!